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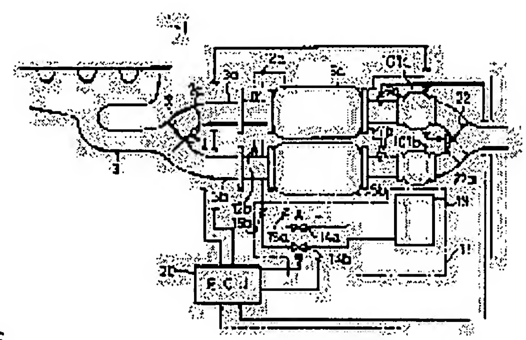
(54) EXHAUST EMISSION CONTROL DEVICE

(57)Abstract:

PURPOSE: To regenerate an NOx absorbent in an effective manner by properly controlling the amount of a reducer to be fed to this NOx absorbent at the time of regenerative operation.

CONSTITUTION: An exhaust passage 3 of an internal combustion engine 1 is branched off into two parts, and two NOx absorbents 5a and 5b are connected to them parallelly. In addition, a flow of exhaust gas is selected by two exhaust selector valves 2 and 22, and a rate of exhaust flow passing through the NOx absorbent on one side is reduced, while a reducer is fed to the NOx absorbent whose exhaust flow rate is lowered from two reducer feed nozzles 12a and 12b and thus regeneration is carried out. Two oxygen content sensors 7a and 7b are installed downstream at each of NOx absorbents and oxidation catalysts 101a and 101b installed in the more downstream side, respectively and in time of regeneration, a reducer supply is controlled on the basis of each output of the oxygen content sensors. During the regeneration, an oxygen ingredient being penetrated from the branched passage on the other is consumed by the oxidation catalysts, and thereby it is not reached to the oxygen content sensors, so that accurate reducer supply control is made achievable in this way.



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CLAIMS

[Claim(s)]
[Claim 1] The exhaust emission control device of an internal combustion engine characterized by providing the following. Two branching paths which are the exhaust emission control devices of the internal combustion engine which performs RIN air-fuel ratio operation, and were mutually connected to the flueway of the aforementioned internal combustion engine in parallel. NOX under exhaust air when the air-fuel ratio of the flowing exhaust air arranged at each of this branching path is RIN NOX which was absorbed, and was absorbed when an exhaust air oxygen density fell NOX to emit Absorbent. Above NOX Exhaust air change-over valve which can reduce individually the exhaust air flow rate which flows into an absorbent, respectively. Above NOX The reducing-agent feeder which can supply a reducing agent to each of an absorbent individually, NOX of each above It has the oxygen density sensor which detects the oxygen density of exhaust air in the downstream branching path of an absorbent. Above NOX NOX under exhaust air to one side of an absorbent It is one [this] NOX by the exhaust air change-over valve aforementioned after making it absorb. The exhaust air flow rate which flows into an absorbent is reduced. It is based on the output of the aforementioned oxygen density sensor, and is one [this] NOX from the aforementioned reducing-agent feeder. A reducing agent is supplied to an absorbent. One [this] NOX NOX absorbed from the absorbent NOX emitted while making it emit It is Above NOX by turns about the operation which carries out reduction purification. In the exhaust emission control device of the internal combustion engine performed about an absorbent An oxygen consumption means to consume the oxygen which flows backwards in the aforementioned oxygen density sensor from the aforementioned branching path downstream.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention is NOX under exhaust air of internal combustion engines which perform combustion of a RIN air-fuel ratio, such as a gasoline engine which performs a diesel power plant and lean combustion, in detail about the exhaust emission control device of an internal combustion engine. It is effectively related with a removable exhaust emission control device.
[0002]
[Description of the Prior Art] As an example of this kind of exhaust emission control device, there are some which were indicated by the Provisional-Publication-No. 62-No. 106826 official report, for example. The equipment of this official report is NOX under existence of oxygen to the flueway of a Diesel engine. The absorbent (catalyst) to absorb is connected to 2 parallel, and it is one NOX about exhaust air. It leads to an absorbent and is NOX under exhaust air. It absorbs. Moreover, above-mentioned one NOX NOX of an absorbent The absorbed dose increases and it is NOX of an absorbent. If absorptance is saturated, it is another NOX about the flow of exhaust air by the exhaust air change-over valve. NOX which led to the absorbent and carried out [above-mentioned] saturation It is this NOX while intercepting the inflow of the exhaust air to an absorbent. A reducing agent is supplied to an absorbent. NOX saturated by this An absorbent to NOX NOX emitted and emitted Reduction purification is carried out with a reducing agent (on these specifications, operation with the NOX discharge from this NOX absorbent and reduction purification is called "reproduction operation of a NOX absorbent"). That is, with the equipment of this official report, they are two NOX(s). Reproduction operation of an absorbent is performed by turns.
[0003] With the equipment of above-mentioned JP,62-106826,A, it is NOX. It is NOX at the time of reproduction operation of an absorbent. It considers as a constant rate and the amount of the reducing agent supplied to an absorbent is NOX. NOX of an absorbent The control according to the absorbing state is not made. For this reason, it is NOX by shortage of the amount of supply of a reducing agent. Reproduction of an absorbent becomes inadequate or a problem by which the reducing agent which was not used for reproduction because of the oversupply of a reducing agent is emitted into the atmosphere arises.
[0004] This problem is NOX. At the time of absorbent reproduction operation, it is NOX. It is solvable by controlling the reducing-agent amount of supply so that the air-fuel ratio of the exhaust air which passed the absorbent becomes near the theoretical air fuel ratio. Namely, NOX It is NOX when the reducing-agent amount of supply to an absorbent runs short. Since the oxygen under exhaust air which flows into an absorbent all cannot be consumed, the air-fuel ratio of the exhaust air which passed the NOX absorbent serves as RIN. Moreover, NOX Since some supplied reducing agents are not consumed by reproduction operation but it flows into a downstream when the reducing-agent amount of supply to an absorbent is excessive, it is NOX. The air-fuel ratio of the exhaust air which passed the absorbent becomes rich. On the other hand, NOX It is NOX to which the oxygen under exhaust air was completely consumed with the reducing agent when the amount of the reducing agent supplied to an absorbent was suitable, and the reducing agent supplied further was emitted with the oxygen consumption under exhaust air. Since it is completely consumed by reduction purification, it is NOX. The air-fuel ratio of the exhaust air which passed the absorbent is because it becomes near the theoretical air fuel ratio.
[0005] For this reason, NOX The oxygen density sensor which detects the oxygen density under exhaust air to an absorbent outlet side is formed, and it is based on the output of this oxygen density sensor, and is NOX. As the oxygen density of the exhaust air which passed the absorbent becomes a value near the theoretical-air-fuel-ratio equivalent value, it becomes possible by controlling the reducing-agent amount of supply from a reducing-agent feeder to control the amount of supply of a reducing agent appropriately.
[0006]

[Problem(s) to be Solved by the Invention] However, it is NOX as mentioned above. If an oxygen density sensor is formed in an absorbent outlet side and the reducing-agent amount of supply is controlled, a problem may arise. Hereafter, this problem is explained with reference to drawing 6 . Drawing 6 is NOX as mentioned above. It is drawing showing the composition at the time of forming an oxygen density sensor in an absorbent outlet, and controlling the reducing-agent amount of supply based on the output of this oxygen density sensor. In drawing 6 , the internal combustion engine with which 1 performs RIN air-fuel ratio operation, and 3 show an engine's 1 flueway. It can have branched to two flueways 3a and 3b by the downstream, the exhaust air change-over valve 2 can be formed in the branch point of the branching paths 3a and 3b, and a flueway 3 can lead now the great portion of engine exhaust air to one side of Flueways 3a or 3b by the change of this exhaust air change-over valve 2.

[0007] Moreover, NOX under exhaust air when the oxygen density which flows into each of the branching paths 3a and 3b is RIN NOX absorbed when it absorbed and the oxygen density of the flowing exhaust air fell NOX to emit Absorbents 5a and 5b are formed. It is NOX at the time of reproduction operation that 12a and 12b showed drawing 6 . It is NOX of the branching paths 3a and 3b that the reducing-agent supply nozzle which supplies a reducing agent, and 7a and 7b showed to Absorbents 5a and 5b. It is the oxygen density sensor formed in absorbent 5a and 5b outlet side. Furthermore, the branching paths 3a and 3b join again by oxygen density sensor 7a and 7b downstream, and the above-mentioned exhaust air change-over valve 2 and the same downstream exhaust air change-over valve 22 are formed in branching path 3a and 3b unification section.

[0008] By the composition shown in drawing 6 , it is one NOX. It switches to the position which showed the exhaust air change-over valves 2 and 22 in drawing as the solid line when an absorbent (for example, NOX absorbent 5a) was reproduced, and is NOX in the great portion of exhaust air of an engine 1. It passes to the absorbent 5b side, and is NOX. It is NOX under exhaust air at absorbent 5b. It absorbs and is NOX. The flow rate of the exhaust air which flows into absorbent 5a is reduced sharply. Moreover, it is reducing-agent supply nozzle 12a to NOX at this time. A reducing agent is supplied to absorbent 5a, and it is NOX. Absorbent 5a is reproduced. Moreover, another NOX absorbent (when the NOX absorbed dose of NOX absorbent 5b increases and NOX absorptance approaches saturation, the exhaust air change-over valves 2 and 22 are switched to the position of the dotted line of drawing 6 , and NOX under exhaust air is absorbed with the NOX absorbent (NOX absorbent 5a) which reproduction completed.) Moreover, it is NOX about reducing-agent supply nozzle 12b to a reducing agent at this time. Absorbent 5b is supplied and it is NOX. Absorbent 5b is reproduced. That is, by the composition of drawing 6 , it is NOX. Absorbents 5a and 5b are reproduced by turns, and are NOX of another side during one reproduction. It is NOX under exhaust air with an absorbent. It absorbs.

[0009] However, it sets in composition like drawing 6 , and is NOX. In order to make proper the amount of the reducing agent supplied to Absorbents 5a and 5b It is NOX about the reducing-agent amount of supply from the reducing-agent supply nozzles 12a and 12b. If feedback control is carried out based on absorbent 5a, oxygen density sensor 7a of 5b outlet side, and 7b output The reducing-agent amount of supply may become excessive generally, and the problem that the amount of the intact reducing agent emitted to the atmosphere increases may arise.

[0010] This problem is NOX as a result of examination of applicants for this patent. NOX of the side reproduced at the time of absorbent reproduction The oxygen density detected by the oxygen density sensor formed in the absorbent outlet is NOX. It has become clear to be generated in order to direct an oxygen density higher than the oxygen density of the exhaust air which passed the absorbent. Thus, the oxygen density sensor by the side of reproduction is NOX. It is thought that directing an oxygen density higher than the oxygen density of the exhaust air which passes an absorbent is based on the following reasons.

[0011] Namely, NOX NOX of the side reproduced in order to reduce the amount of reducing agents for consuming the oxygen component under exhaust air at the time of absorbent reproduction The flow rate of the exhaust air which flows into an absorbent is sharply reduced by the exhaust air change-over valves 2 and 22. For this reason, NOX under reproduction At the branching path by the side of an absorbent, the exhaust air rate of flow falls sharply. Moreover, the exhaust air oxygen density in this branching path becomes very low by reducing-agent supply. Thus, as a result of a difference's arising in the oxygen density of exhaust air in both branching path 3a and 3b, in exhaust air change-over valve 22 portion of the unification section, an oxygen density comes to move by diffusion towards a low side (NOX absorbent side under reproduction) in the oxygen by which an oxygen density is contained in exhaust air of a high side (NOX absorbent side while absorbing NOX). On the other hand, it is NOX under reproduction. In the absorbent side, the exhaust air rate of flow is falling sharply as mentioned above. for this reason, the oxygen which passed the exhaust air change-over valve 22, and invaded -- NOX under reproduction the inside of the branching path by the side of an absorbent -- being spread -- flowing backwards -- just -- being alike -- up to an oxygen density sensor position -- reaching -- coming -- directions of the oxygen density sensor 7 -- actually -- NOX The phenomenon which becomes higher than the oxygen density of the exhaust air which passed the absorbent arises.

[0012] It sets to drawing 6 and drawing 7 is NOX under reproduction. The result which actually inserted the oxygen density sensor in branching path 3a each position by the side of an absorbent (NOX absorbent 5a), and measured the oxygen density of each portion is shown. drawing 7 -- setting -- Section I -- the exhaust air change-over valve 2 to NOX the oxygen density of the section to an absorbent 5a entrance -- Section II -- NOX NOX from an absorbent 5a entrance to an outlet the oxygen density of the section inside an absorbent -- moreover, the section III NOX The oxygen density of the section from the absorbent 5a outlet to the downstream exhaust air change-over valve 22 is shown, respectively (refer to drawing 6). Since the reducing agent supplied in Section I has not reacted with the oxygen under exhaust air yet as shown in drawing 7 , the oxygen density under exhaust air is high, and in Section II, it is NOX. The oxygen under a reducing agent and exhaust air reacts by the catalysis of an absorbent, and since oxygen is consumed, the oxygen density is falling near abbreviation zero. however -- the edge (near the downstream end face of NOX absorbent 5a) of Section II -- an oxygen density -- again -- elevation -- changing -- Section III **** -- the oxygen density is high as the downstream exhaust air change-over valve 22 is approached That is, it is NOX by diffusion of the oxygen-content child who invades through the exhaust air change-over valve 22. In an absorbent downstream, it turns out that the inclination for the oxygen density under exhaust air to become high has arisen as the exhaust air change-over valve 22 is approached. That the dotted line showed to drawing 7 shows the result at the time of switching exhaust air to the unification section of the branching paths 3a and 3b only using the upstream exhaust air change-over valve 2, without forming the downstream exhaust air change-over valve 22. In this case, the amount of the oxygen which invades since there is no downstream exhaust air change-over valve 22 increases further, and is NOX. The oxygen density in an absorbent downstream is still higher. Moreover, although not illustrated, when it opens wide to the atmosphere individually, without making the branching paths 3a and 3b join, it has become clear that the same reduction arises by diffusion of the oxygen from an atmosphere side.

[0013] Original and NOX It is necessary to control the amount of the reducing agent supplied to an absorbent based on the oxygen density near the section II center of drawing 7 . However, by composition like drawing 6 , the reducing-agent amount of supply is the above-mentioned section III. Since it will be controlled based on an oxygen density higher than the section II of a portion, the above-mentioned problem that the amount of supply of a reducing agent becomes excessive arises. This problem is NOX. An oxygen density sensor is inserted into an absorbent, and it is solvable if the oxygen density in drawing 7 and Section II is detected correctly. However, NOX Since it reaches to an extreme engine on stream and becomes an elevated temperature, an absorbent is NOX about an oxygen density sensor. If it inserts into an absorbent, the problem of the endurance of a sensor will arise. Moreover, NOX It is NOX to insert a sensor into an absorbent. Since problems, such as a mechanical-strength fall of the absorbent itself, are produced, it is not desirable.

[0014] this invention takes an example by the above-mentioned problem, and is NOX. It is NOX, without inserting a sensor into an absorbent. By the oxygen density sensor arranged to the absorbent downstream, it is NOX. It aims at offering the means which enables correctly detection of the oxygen density of the exhaust air which passed the absorbent.

[0015]

[Means for Solving the Problem] Two branching paths which according to this invention are the exhaust emission control devices of the internal combustion engine which performs RIN air-fuel ratio operation, and were mutually connected to the flueway of the aforementioned internal combustion engine in parallel, NOX under exhaust air when the air-fuel ratio of the flowing exhaust air arranged at each of this branching path is RIN NOX which was absorbed, and was absorbed when an exhaust air oxygen density fell The NOX absorbent to emit, Above NOX The exhaust air change-over valve which can reduce individually the exhaust air flow rate which flows into an absorbent, respectively, Above NOX The reducing-agent feeder which can supply a reducing agent to each of an absorbent individually, NOX of each above It has the oxygen density sensor which detects the oxygen density of exhaust air in the downstream branching path of an absorbent. Above NOX NOX under exhaust air to one side of an absorbent It is one [this] NOX by the exhaust air change-over valve aforementioned after making it absorb. The exhaust air flow rate which flows into an absorbent is reduced. It is based on the output of the aforementioned oxygen density sensor, and is one [this] NOX from the aforementioned reducing-agent feeder. A reducing agent is supplied to an absorbent. One [this] NOX NOX absorbed from the absorbent NOX emitted while making it emit About the operation which carries out reduction purification, it is Above NOX by turns. In the exhaust emission control device of the internal combustion engine performed about an absorbent The exhaust emission control device of the internal combustion engine characterized by establishing an oxygen consumption means to consume the oxygen which flows backwards in the aforementioned oxygen density sensor from the aforementioned branching path downstream is offered.

[0016]

[Function] NOX The oxygen which flows backwards towards an oxygen density sensor from a downstream by

diffusion at the time of absorbent reproduction is consumed by the oxygen consumption means. for this reason, it prevents that the oxygen which flows backwards from a downstream reaches an oxygen density sensor -- having -- NOX the oxygen density of exhaust air near [at the time of absorbent reproduction] the oxygen density sensor -- NOX the oxygen density (a part for drawing 7 and a section II center section) of the exhaust air which passed the absorbent, and abbreviation -- equal -- becoming -- an oxygen density sensor output -- NOX It comes to express correctly the oxygen density of the exhaust air which passed the absorbent.

[0017]

[Example] The example of this invention is explained using an accompanying drawing below. Drawing 1 shows the composition of one example of the exhaust emission control device of this invention. In drawing 1 , the same reference mark as drawing 6 shows the same element as drawing 6 . In drawing 1 , the internal combustion engine which can burn RIN air-fuel ratios, such as a gasoline engine to which 1 performs a diesel power plant and lean combustion, and 3 show the flueway of an internal combustion engine 1. NOX which two branching paths 3a and 3b are established in the flueway 3, and absorbed NOX under exhaust air when the exhaust air air-fuel ratio which flows into Paths 3a and 3b like the after-mentioned is RIN, and was absorbed when the oxygen density under exhaust air fell Each of NOX absorbents 5a and 5b to emit are connected.

[0018] Moreover, the exhaust air change-over valve 2 is formed in the tee of the paths 3a and 3b of a flueway 3, it is closed down to predetermined opening with arbitrary while Flueways 3a and 3b, and exhaust air is distributed to Flueways 3a and 3b. For example, if the exhaust air change-over valve 2 is switched to the position shown in drawing 1 as the solid line, the exhaust air flow rate which the great portion of exhaust air flows into the branching path 3b side, and flows into the branching path 3a side will be reduced. Moreover, if the exhaust air change-over valve 2 is switched to the position shown in drawing 1 by the dotted line, the exhaust air flow rate which the great portion of exhaust air flows into the branching path 3a side, and flows into the branching path 3b side will be reduced. It is the actuator of proper form for driving a change-over valve 2 with the control signal from the engine control circuit (ECU) 20 mentioned later, and making it take a predetermined switch position, such as a negative pressure actuator, which is shown in drawing by 2a.

[0019] Moreover, the branching paths 3a and 3b are NOX. It joins again by absorbent 5a and 5b downstream, and the exhaust air change-over valve 2, the same exhaust air change-over valve 22, and actuator 22a are prepared in this unification section. The exhaust air change-over valve 22 is interlocked with the exhaust air change-over valve 2, operates, and is NOX under reproduction. It has prevented that the exhaust air from another branching path flows backwards to the near branching path of an absorbent.

[0020] Furthermore, NOX of the branching paths 3a and 3b The reducing-agent feeder 11 later mentioned to absorbent 5a and 5b upstream to NOX Each of reducing-agent supply nozzles 12a and 12b which supply a reducing agent are connected to Absorbents 5a and 5b. Moreover, it is NOX of the branching paths 3a and 3b that 7a and 7b show to drawing 1 , respectively. It is the oxygen density sensor arranged at absorbent 5a and 5b downstream. The oxygen density sensors 7a and 7b are NOX. The oxygen density under exhaust air which passed Absorbents 5a and 5b is detected. Like [in this example] the after-mentioned, it is NOX. It is NOX under [the reducing-agent feeder 11 to] reproduction during reproduction of Absorbents 5a and 5b. The reducing-agent amount of supply supplied to Absorbents 5a and 5b is controlled according to the output of the oxygen density sensors 7a and 7b.

[0021] Moreover, in this example, the oxidation catalysts 101a and 101b as an oxygen consumption means are formed in oxygen density sensor 7a of each branching path 3a and 3b, and 7b downstream. It is the control circuit (ECU) of an engine 1 which is shown in drawing by 20. ECU20 consists of a well-known digital computer of composition of having connected CPU, RAM, ROM and input port, and the output port mutually by the bi-directional bus, and is performing basic control, such as fuel-oil-consumption control of an engine. Moreover, ECU20 drives Actuators 2a and 22a further through a drive circuit, a negative pressure-limiting valve, etc. which are not illustrated, and performs switch position control of the exhaust air change-over valves 2 and 22, and also it controls the reducing-agent amount of supply from the reducing-agent feeder 11 by this example based on the output of the oxygen density sensors 7a and 7b. For these control, the oxygen density signal from the oxygen density sensors 7a and 7b is inputted, and also signals, such as an engine speed and an engine inhalation air content, are inputted into the input port of ECU20 from the sensor which is not illustrated, respectively.

[0022] Oxidation catalysts 101a and 101b perform the operation as an oxygen consumption means which consumes the oxygen which flows backwards from a downstream by making the oxygen which flows backwards the branching paths 3a and 3b from a downstream through the exhaust air change-over valve 22 react with the reducing agent under exhaust air which passes an oxidation catalyst so that oxidation catalysts, such as Platinum Pt and palladium, may be later supported and mentioned to the metal support of the shape for example, of a honeycomb.

[0023] The reducing-agent feeder 11 is equipped with the check valves 15a and 15b for exhaust air antisuckbacks

arranged between the control valves 14a and 14b which adjust the flow rate of the reducing agent supplied to the reducing-agent supply nozzles 12a and 12b from the reducing-agent source of supply 13 which consists of a reducing-agent container, a booster pump, etc., and the reducing-agent source of supply 13, and Nozzles 12a and 12b and control valves 14a and 14b. Control valves 14a and 14b are NOX mentioned later. It is NOX about the reducing agent of an amount according to the control signal of ECU20, take predetermined opening, and corresponding to opening at the time of reproduction operation of Absorbents 5a and 5b. Absorbents 5a and 5b are supplied.

[0024] NOX NOX of Absorbents 5a and 5b Liquid fuel, such as a hydrocarbon of the shape of liquefied or a gas, such as gases, such as hydrogen and a carbon monoxide, and a propane, a propylene, butane, or a gasoline, gas oil, and lamp oil, etc. can be used that what is necessary is just what is exhausting and generates reduction components and hydrocarbon components, such as a carbon monoxide, as a reducing agent used for discharge and reduction operation (reproduction operation).

[0025] NOX Absorbents 5a and 5b use support, such as an alumina, and are Potassium K, Sodium Na, Lithium Li, and Caesium Cs on this support. Alkali metal [like] and barium Ba, Calcium calcium At least one chosen from an alkaline earth [like], Lanthanum La, and rare earth like Yttrium Y, and platinum Pt Noble metals [like] are supported. This NOX Absorbents 5a and 5b are NOX when the air-fuel ratio of the flowing exhaust air is RIN. It is NOX, if it absorbs and an oxygen density falls. NOX to emit An absorption/emission action is performed.

[0026] In addition, an above-mentioned exhaust air air-fuel ratio is NOX here. The ratio of the sum total of the air content supplied to the flueway of the upstream of Absorbents 5a and 5b, an engine combustion chamber, an inhalation-of-air path, etc., respectively, and the fuel and the sum total of a reducing agent shall be meant. Therefore, NOX When fuel, a reducing agent, or air is not supplied to the upstream flueway of Absorbents 5a and 5b, an exhaust air air-fuel ratio becomes equal to the operation air-fuel ratio (air-fuel ratio in combustion of an engine combustion chamber) of an engine.

[0027] Since the engine which burns a RIN air-fuel ratio is used in this example, the exhaust air air-fuel ratio at the time of operation is usually RIN, and it is NOX. Absorbents 5a and 5b are NOX under exhaust air. It absorbs. Moreover, it is NOX, if a reducing agent is introduced during exhaust air from the reducing-agent feeder 11 and an oxygen density falls. Absorbents 5a and 5b emit the absorbed reducing agent. There is also a portion which is not clear about the detailed mechanism of this absorption/emission action. However, it is thought that this absorption/emission action is performed by the mechanism as shown in drawing 5 . Next, it is Platinum Pt on support about this mechanism. And barium Ba It becomes the same mechanism, even if it uses other noble metals, alkali metal, an alkaline earth, and rare earth, although explained taking the case of the case where it is made to support.

[0028] That is, if inflow exhaust air becomes remarkable RIN, the oxygen density under inflow exhaust air will increase sharply, and it is drawing 5 (A). It is these oxygen O2 so that it may be shown. O2 - Or O2 - It is Platinum Pt in a form. It adheres to a front face. on the other hand -- NO under inflow exhaust air -- platinum Pt a front-face top -- this O2- or O2- reacting -- NO2 It becomes (2 NO+O2 ->2NO2). Subsequently, generated NO2 A part is drawing 5 (A), being absorbed in an absorbent and combining with a barium oxide BaO oxidizing on Platinum Pt. It is a nitrate ion NO3 so that it may be shown. - It is spread in an absorbent in a form. Thus, NOX NOX It is absorbed in absorbent 5a and 5b.

[0029] Therefore, it is Platinum Pt as long as the oxygen density under inflow exhaust air is high. It is NO2 in a front face. It is generated and is NOX of an absorbent. It is NO2 unless absorptance is saturated. It is absorbed in an absorbent and is a nitrate ion NO3. - It is generated. On the other hand, the oxygen density under inflow exhaust air falls, and it is NO2. When the amount of generation decreases, a reaction progresses to an opposite direction (NO3-->NO2), and it is the nitrate ion NO3 in an absorbent in this way. - NO2 It is emitted from an absorbent in a form. That is, it is NOX if the oxygen density under inflow exhaust air falls. Absorbents 5a and 5b to NOX It will be emitted.

[0030] On the other hand, these components are Platinum Pt if reduction components, such as HC and CO, exist during inflow exhaust air. Upper oxygen O2 - Or it reacts with O2-, and oxidizes, the oxygen under exhaust air is consumed, and the oxygen density under exhaust air is reduced. Moreover, it is NOX by the oxygen density fall under exhaust air. NO2 emitted from Absorbents 5a and 5b Drawing 5 (B) It reacts with HC and CO and is returned so that it may be shown. Thus, platinum Pt It is NO2 on a front face. When it stops existing, it is NO2 from an absorbent to the degree from a degree. It is emitted.

[0031] namely, HC under inflow exhaust air and CO -- first -- platinum Pt Upper O2- or it reacts immediately with O2- and oxidizes -- having -- subsequently -- platinum Pt Upper O2- Or NOX emitted by this HC and CO from the absorbent when HC and CO still remained, even if O2- was consumed and NOX which flows with exhaust air It is returned. At this example, it is NOX by turns by operation of the exhaust air change-over valves 2 and 22. NOX of Absorbents 5a and 5b Absorption and discharge are performed. That is, at this example, it is one NOX by operation of the exhaust air change-over valves 2 and 22. A great portion of exhaust air is passed to an absorbent (for example, 5a),

and it is made to absorb NOX. Moreover, predetermined time NOX set up beforehand It absorbs and is NOX. NOX of absorbent 5a If the absorbed dose increases, the exhaust air change-over valves 2 and 22 are switched, and it is NOX of another side. Exhaust air is passed to absorbent 5b, and it is NOX. While reducing the exhaust air flow rate which flows into absorbent 5a, it is reducing-agent supply nozzle 12a to NOX. A reducing agent is supplied to absorbent 5a, and it is NOX. Absorbent 5a is reproduced. Moreover, the predetermined time after a change passes and it is NOX. NOX of absorbent 5b If the absorbed dose increases, the exhaust air change-over valves 2 and 22 are switched again, and it is NOX. Exhaust air is passed to the absorbent 5a side, and it is NOX. NOX by absorbent 5a It is NOX while resuming absorption. Absorbent 5b is reproduced.

[0032] At this example, it is NOX. In order to reduce the amount of the reducing agent used for reproduction of Absorbents 5a and 5b NOX reproduced by switching the position of the exhaust air change-over valves 2 and 22 While reducing the flow rate of the exhaust air which flows into an absorbent and reducing the amount of a reducing agent required in order to consume the oxygen under exhaust air NOX under reproduction Based on the output of the oxygen density sensor formed in the outlet side of an absorbent, the reducing-agent amount of supply from the reducing-agent feeder 11 is controlled, and it is NOX. It is made to supply the reducing agent of the suitable amount for an absorbent.

[0033] Drawing 2 is NOX of this example. It is the flow chart which shows reproduction operation control of Absorbents 5a and 5b. This routine is performed for every predetermined time by the engine control circuit (ECU) 20. If a routine starts in drawing 2 , at Step 201, it is NOX now. NOX while performing absorption It is judged whether the reproduction operation execution condition of an absorbent is satisfied. Here, it is NOX. The reproduction operation execution condition of an absorbent ** NOX Absorption time (elapsed time of since a NOX absorbent is switched last time) is over a predetermined time, ** the time check which a routine progresses to Step 221 and is later mentioned when it comes out, and it is and the above-mentioned ** or ** is not materialized, that an engine exhaust-gas temperature is beyond a predetermined value and -- end a routine after setting the value of the change flag F of Counter T and an exhaust air change-over valve to zero It is NOX at the above-mentioned **. NOX of an absorbent Having judged absorption time NOX NOX of an absorbent It is NOX only when the absorbed dose increases to some extent. Being for reproducing an absorbent and avoiding execution of frequent reproduction operation, and having judged the exhaust-gas temperature by the above-mentioned ** An exhaust-gas temperature is a low and NOX. NOX at the time of supplying a reducing agent, since the temperature of the absorbent itself is also low NOX from an absorbent It is because discharge speed cannot fall and efficient reproduction operation cannot be performed.

[0034] Therefore, in this example, only when both conditions of the above-mentioned ** and ** are satisfied at Step 201, reproduction operation of Step 203 to the step 219 is performed. That is, it is NOX at Step 201. When the reproduction conditions of an absorbent are satisfied It judges whether the value of the change flag F of an exhaust air change-over valve is set to 1 at Step 203. NOX in which the exhaust air change-over valves 2 and 22 were switched at Step 205 in the case of F!=1, and reproduction conditions were satisfied The flow rate of the exhaust air which flows into the branching path by the side of an absorbent is reduced to the specified quantity, and it progresses to Step 209, after setting the value of Flag F at Step 207 subsequently to 1. Moreover, in the case of F-1, it progresses to the direct step 211 at Step 203, without switching an exhaust air change-over valve. The above-mentioned change flag F is NOX. It is the flag used in order to switch the exhaust air change-over valves 2 and 22 only once after reproduction condition formation of an absorbent.

[0035] Step 209 shows the judgment of whether the end conditions of reproduction operation are satisfied. namely, -- Step 209 -- a time check -- the value of Counter T -- predetermined value T0 ****** above judges -- having -- T>=T0 it is -- if -- The set point R of control valve 14a (or 14b) of the reducing-agent feeder 11 is set to zero, it progresses to Step 219, and the opening of control valve 14a (or 14b) of the reducing-agent feeder 11 is controlled (in this case, since it is R= zero, let both the control valves 14a and 14b be close by-pass bulb completelies.). . Here, it is the predetermined value T0. NOX It is time required for reproduction of an absorbent, and is NOX. It is beforehand set up by the type of an absorbent, size, etc. by experiment etc. That is, when it judges whether the elapsed time T after a reproduction operation start has become beyond the predetermined reproduction execution time at Step 211 and predetermined-time execution of the reproduction operation is carried out, control valve 14a (or 14b) of a reducing-agent feeder is made into a close by-pass bulb completely at Step 210, and it is NOX. The reducing-agent supply to an absorbent is stopped.

[0036] It is NOX of the side which a routine progresses to Step 211 when the reproduction operation execution time predetermined at Step 209 has not passed, and performs reproduction operation. Reading of the oxygen density C under exhaust air is performed from the oxygen density sensor (7a or 7b) arranged on the absorbent lower stream of a river, and more than the oxygen density CST of theoretical air fuel ratio and no (that is, is an exhaust air air-fuel ratio RIN?) are judged for this oxygen density C at Step 212.

[0037] When the exhaust air air-fuel ratio detected by the oxygen density sensor (7a or 7b) at Step 212 is RIN

(C>=CST), Step 213 is performed, only in a constant rate alpha, the opening of the control valve (14a or 14b) of a reducing-agent feeder increases, and the reducing-agent amount of supply increases. Moreover, at Step 212, when an exhaust air air-fuel ratio is rich, Step 215 is performed, only a constant rate beta is reduced and, as for control valve opening, the reducing-agent amount of supply is reduced. Here, alpha and beta are the constant value set up beforehand. The value of alpha and beta is NOX by preparing a difference in the value of alpha and beta, although it is good also as the same. The air-fuel ratio of the exhaust air which passes an absorbent is maintainable from theoretical air fuel ratio to a rich or RIN side. For example, by considering as alpha>beta, an exhaust air air-fuel ratio is maintained a little from theoretical air fuel ratio at a rich side.

[0038] moreover -- the above-mentioned step 217 after operation execution -- a time check -- the value of Counter T counts up plus 1 and it is outputted to the drive circuit which the control valve opening R set up at Steps 213 or 215 does not illustrate at Step 219 By execution of the above-mentioned routine, it is NOX. At the time of absorbent reproduction, it is the NOX. Feedback control of the reducing-agent amount of supply is carried out so that a downstream exhaust air air-fuel ratio may turn into theoretical air fuel ratio based on the oxygen density sensor output of an absorbent downstream. For this reason, the output of the oxygen density sensors 7a and 7b is NOX. It is necessary to detect correctly the oxygen density under exhaust air which passes Absorbents 5a and 5b.

[0039] As mentioned above, in this example, the oxidation catalysts 101a and 101b as an oxygen consumption means are formed in the branching paths 3a and 3b of oxygen density sensor 7a and 7b downstream. For this reason, NOX The downstream exhaust air change-over valve 22 is passed during reproduction of an absorbent, and it is NOX. It is oxidation catalysts 101a and 101b, and is supplied from a reducing-agent feeder, and the oxygen which oxygen diffuses from the near branching path under absorption is NOX in exhaust air. It reacts with the reducing agent which passes an absorbent, and is consumed, and the oxygen density sensors 7a and 7b are not reached. Therefore, the output of the oxygen density sensors 7a and 7b under reproduction operation execution is NOX. It is NOX about a suitable quantity of a reducing agent by reflecting correctly the air-fuel ratio of the exhaust air which passed the absorbent, and controlling the reducing-agent amount of supply based on the output of the oxygen density sensors 7a and 7b. It is possible to supply an absorbent.

[0040] Next, the composition of another example of this invention is shown in drawing 3 . Although the oxidation catalyst was prepared in the branching paths 3a and 3b between the oxygen density sensors 7a and 7b and the exhaust air change-over valve 22 in the example of drawing 1 , respectively, it is drawing 3 (A). The point of using the exhaust air change-over valve 102 which unified and included the oxidation catalyst in the exhaust air change-over valve is different instead of preparing the oxidation catalyst which became independent to each branching paths 3a and 3b in this example so that it may be shown.

[0041] That is, the exhaust air change-over valve 102 of this example is drawing 3 (B). It considers as the composition which fitted in metal support 102b of the shape of a honeycomb which supported the oxidation catalyst in the center of disc-like valve element 102a so that it might be shown, and is NOX. The exhaust air which passed the absorbent passes this catalyst support, and flows in the unification section. NOX under reproduction It is only producing invasion of oxygen to the branching path by the side of an absorbent by diffusion by the concentration difference, and there are comparatively few the amounts. Therefore, even if an oxidation catalyst is a comparatively small capacity, it can fully prevent attainment of the oxygen to the oxygen density sensors 7a and 7b. For this reason, in the example of drawing 3 , attainment of the oxygen to the oxygen density sensors 7a and 7b is prevented by including the oxidation catalyst of small capacity in an exhaust air change-over valve at one, without checking operation of a change-over valve. According to this example, there is an advantage which becomes possible [attaining the same effect as the example of drawing 1 with simple composition].

[0042] Drawing 4 is drawing showing the composition of still more nearly another example of this invention. Although the oxygen density sensor was formed in each branching path in the example of drawing 1 , the single oxygen density sensor 107 is used in this example, and they are both NOX(s). The point of performing reducing-agent amount-of-supply control at the time of reproduction of Absorbents 5a and 5b is different. It sets to drawing 4 and is NOX. Ports 103a and 103b are established in the entrance portion of Absorbents 5a and 5b, and it connects with it through Piping 104a and 104b in the entrance port of the exhaust air change-over valve 2 and the interlocking change-over valve 105. Moreover, the exit port of a change-over valve 105 is NOX of small capacity. It connects with the absorbent 106 and the exhaust air port 110 established in the unification section of the branching paths 3a and 3b through the oxidation catalyst 108 of small capacity, and the exhaust air pump 109 similarly.

[0043] Moreover, the oxygen density sensor 107 single in this example is NOX. It is prepared in piping which connects an absorbent 106 and an oxidation catalyst 108. At this example, it is not prepared but the exhaust air change-over valve 22 of a downstream is NOX. A switch of exhaust air for absorbent reproduction is performed by only the upstream exhaust air change-over valve 2. At this example, a change-over valve 105 is interlocked with the upstream

exhaust air change-over valve 2, and is NOX under reproduction operation execution. It is NOX about the port by the side of an absorbent (103a or 103b). It connects with an absorbent 106. Thereby, it is NOX under reproduction. A part of mixture of the exhaust air and the reducing agent which flow into an absorbent is attracted by the exhaust air pump 109, and it is NOX. An absorbent 106 is passed.

[0044] for this reason, NOX an absorbent 106 -- NOX under reproduction since exhaust air of the same reducing-agent concentration as an absorbent being supplied is supplied -- NOX an exhaust air oxygen density [in / the outlet of the NOX </SUB> absorbent under reproduction / in the oxygen density in absorbent 106 outlet], and abbreviation -- it becomes the same since [moreover,] the oxygen diffused from the exhaust air port 110 is consumed by the oxidation catalyst 108 -- the oxygen density sensor 107 -- not reaching -- an about 107 oxygen density sensor exhaust air oxygen density -- NOX under reproduction the oxygen density of the exhaust air which passed the absorbent, and abbreviation -- it becomes the same

[0045] Therefore, based on the output of the oxygen density sensor 107, it is NOX by performing the same control as drawing 2 . The reducing-agent amount of supply at the time of absorbent reproduction is controlled appropriately. According to this example, the number of the oxygen density sensors to be used is reduced, and there is an advantage which can perform simple control. In addition, although the oxidation catalyst is used in each above-mentioned example as an oxygen consumption means to prevent that the oxygen diffused from a downstream reaches an oxygen density sensor, the oxygen consumption means of this invention is not limited to an oxidation catalyst, and if oxygen and a reducing agent can be made to react, it can be used as an oxygen consumption means. For example, it is NOX of small capacity as an oxygen consumption means instead of an oxidation catalyst. The same effect can be acquired even if it uses an absorbent.

[0046]

[Effect of the Invention] According to this invention, it is NOX. By having established an oxygen consumption means to prevent that the oxygen diffused from a downstream in the oxygen density sensor which detects the exhaust air oxygen density of an absorbent outlet reaches Two NOX(s) connected in parallel with a flueway NOX under reproduction in case an absorbent is reproduced by turns It is based on the oxygen density sensor output of an absorbent downstream, and is NOX. It becomes possible to control correctly the reducing-agent amount of supply to an absorbent. NOX The effect that the inadequate reproduction by the shortage of the reducing-agent amount of supply to an absorbent and discharge of the intact reducing agent to the atmosphere by reducing-agent oversupply can be prevented is acquired.

[Translation done.]

* NOTICES *

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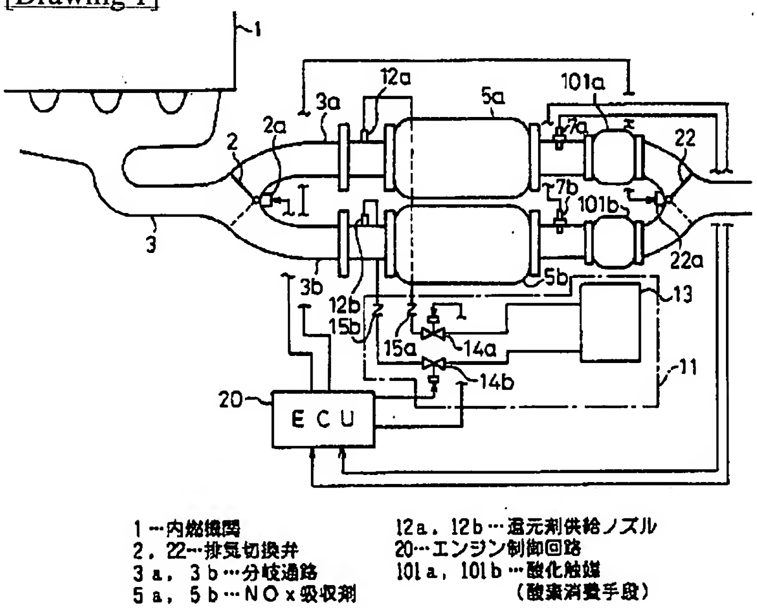
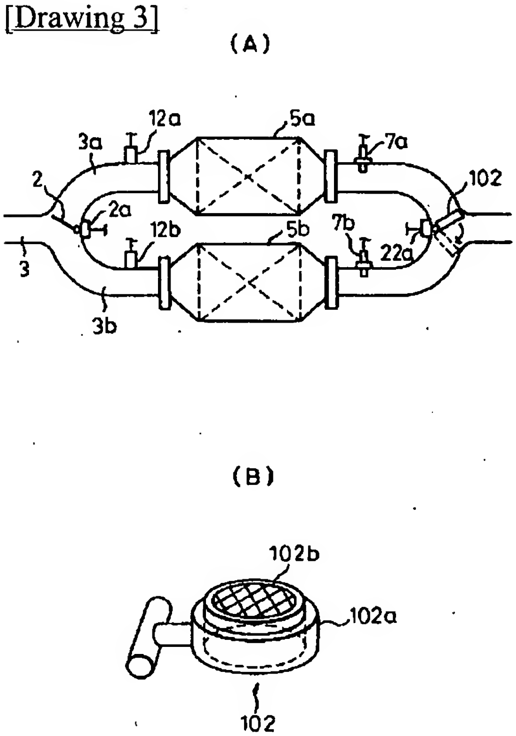
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

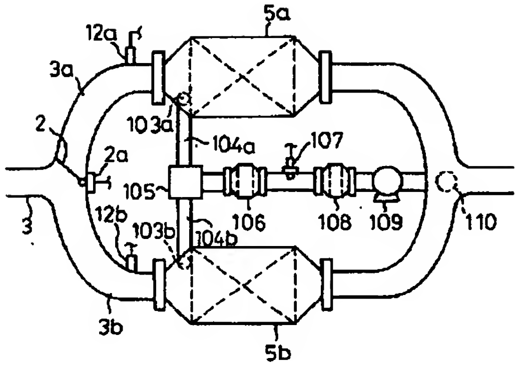
[Drawing 1]



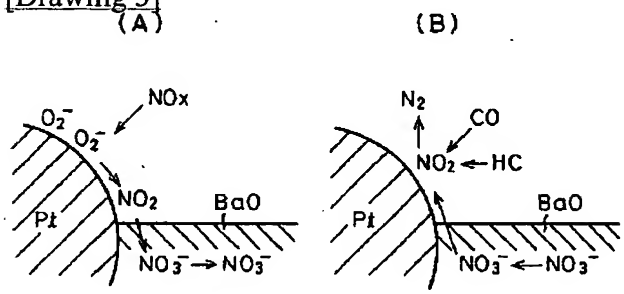
[Drawing 3]



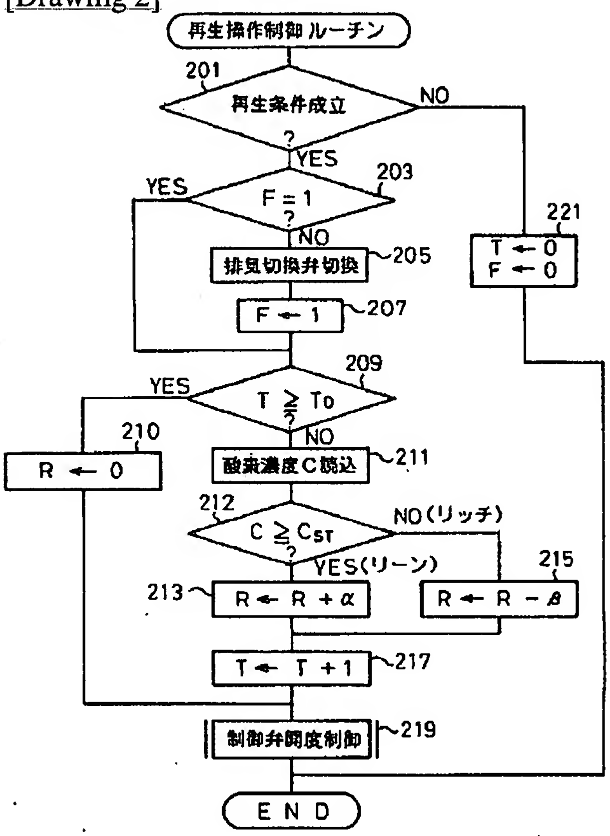
[Drawing 4]



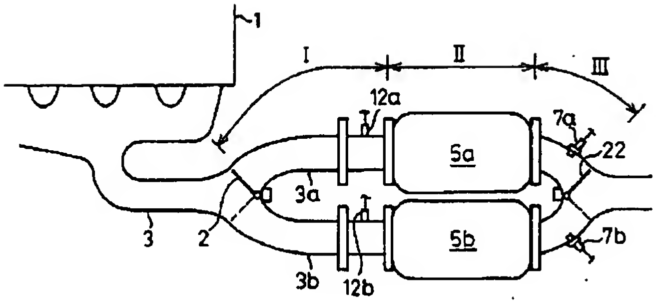
[Drawing 5]



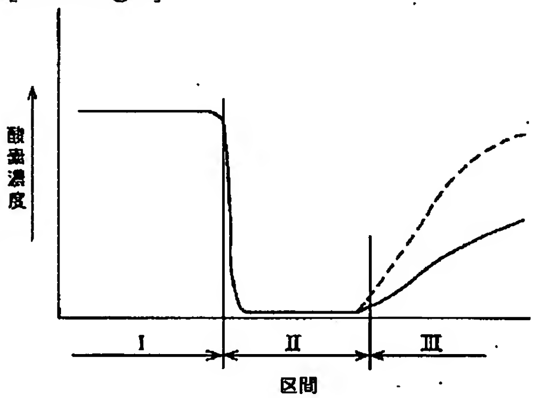
[Drawing 2]



[Drawing 6]



[Drawing 7]



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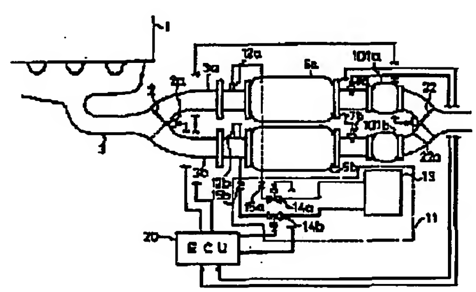
(54) **EXHAUST EMISSION CONTROL DEVICE**

(57) Abstract

PURPOSE: To regenerate an NOx absorbent in an effective manner by properly controlling the amount of a reducer to be fed to this NOx absorbent at the time of regenerative operation.

CONSTITUTION: An exhaust passage 3 of an internal combustion engine 1 is branched off into two parts, and two NOx absorbents 5a and 5b are connected to them parallelly. In addition, a flow of exhaust gas is selected by two exhaust selector valves 2 and 22, and a rate of exhaust flow passing through the NOx absorbent on one side is reduced, while a reducer is fed to the NOx absorbent whose exhaust flow rate is lowered from two reducer feed nozzles 12a and 12b and thus regeneration is carried out. Two oxygen content sensors 7a and 7b are installed downstream at each of NOx absorbents and oxidation catalysts 101a and 101b installed in the more downstream side, respectively and in time of regeneration, a reducer supply is controlled on the basis of each output of the oxygen content sensors. During the regeneration, an oxygen ingredient being penetrated from the branched passage on the other is consumed by the oxidation catalysts, and thereby it is not reached to the oxygen content sensors, so that accurate reducer supply control is made achievable in this way.



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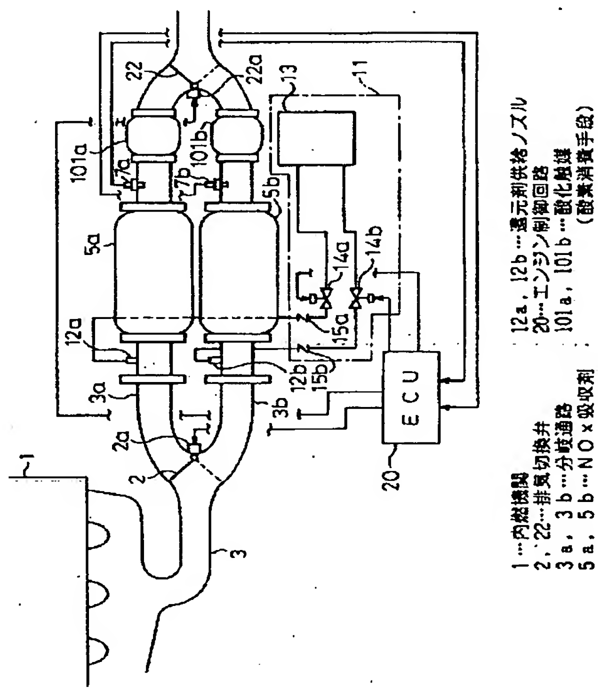
最終頁に続く

(54)【発明の名称】　内燃機関の排気浄化装置

(57)【要約】

【目的】　再生操作時に、NOx 吸収剤に供給する還元剤の量を適切に制御することにより、NOx 吸収剤の効率的な再生を行う。

【構成】　内燃機関1の排気通路3を分岐し、2つのNOx 吸収剤5a、5bを並列に接続する。排気切換弁2、22により排気の流れを切り換えて、一方のNOx 吸収剤を通過する排気流量を低減するとともに、還元剤供給ノズル12a、12bから排気流量が低下したNOx 吸収剤に還元剤を供給して再生を行う。それぞれのNOx 吸収剤下流に酸素濃度センサ7a、7bと、更にその下流に酸化触媒101a、101bを設け、再生時に還元剤供給量を酸素濃度センサの出力に基づいて制御する。再生中に、他の分岐通路から侵入してくる酸素成分は酸化触媒により消費され、酸素濃度センサに到達しないため、正確な還元剤供給量制御が可能となる。



【特許請求の範囲】
【請求項１】　リーン空燃比運転を行う内燃機関の排気浄化装置であって、
前記内燃機関の排気通路に互いに並列に接続された２つの分岐通路と、
該分岐通路のそれぞれに配置された、流入する排気の空燃比がリーンのときに排気中のＮＯx を吸収し、排気酸素濃度が低下したときに吸収したＮＯx を放出するＮＯx 吸収剤と、
前記ＮＯx 吸収剤に流入する排気流量をそれぞれ個別に低減することが可能な排気切換弁と、
前記ＮＯx 吸収剤のそれぞれに個別に還元剤を供給することが可能な還元剤供給装置と、
前記それぞれのＮＯx 吸収剤の下流側分岐通路中の排気の酸素濃度を検出する酸素濃度センサとを備え、
前記ＮＯx 吸収剤の一方に排気中のＮＯx を吸収させた後、前記排気切換弁により該一方のＮＯx 吸収剤に流入する排気流量を低減し、前記酸素濃度センサの出力に基づいて前記還元剤供給装置から該一方のＮＯx 吸収剤に還元剤を供給して、該一方のＮＯx 吸収剤から吸収したＮＯx を放出させるとともに放出されたＮＯx を還元浄化する操作を交互に前記ＮＯx 吸収剤について行う内燃機関の排気浄化装置において、
前記分岐通路下流側から前記酸素濃度センサに逆流してくる酸素を消費する酸素消費手段を設けたことを特徴とする内燃機関の排気浄化装置。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は、内燃機関の排気浄化装置に関し、詳細には、ディーゼルエンジンや希薄燃焼を行うガソリンエンジン等、リーン空燃比の燃焼を行う内燃機関の排気中のＮＯx を効果的に除去可能な排気浄化装置に関する。
【０００２】
【従来の技術】この種の排気浄化装置の例としては、例えば特開昭６２－１０６８２６号公報に開示されたものがある。同公報の装置は、ディーゼル機関の排気通路に酸素の存在下でＮＯx を吸収する吸収剤（触媒）を２つ並列に接続し、排気を一方のＮＯx 吸収剤に導いて排気中のＮＯx の吸収を行う。また、上記一方のＮＯx 吸収剤のＮＯx 吸収量が増大して吸収剤のＮＯx 吸収能力が飽和すると、排気切換弁により、排気の流れをもう一方のＮＯx 吸収剤に導いて上記飽和したＮＯx 吸収剤への排気の流入を遮断するとともに、このＮＯx 吸収剤に還元剤を供給する。これにより、飽和したＮＯx 吸収剤からＮＯx が放出され、放出されたＮＯx が還元剤により還元浄化される（本明細書では、このＮＯx 吸収剤からのＮＯx 放出と還元浄化との操作を「ＮＯx 吸収剤の再生操作」と呼ぶ）。すなわち、同公報の装置では、２つのＮＯx 吸収剤の再生操作が交互に行われる。
【０００３】上記特開昭６２－１０６８２６号公報の装置では、ＮＯx 吸収剤の再生操作時にＮＯx 吸収剤に供給する還元剤の量は一定量とされ、ＮＯx 吸収剤のＮＯx 吸収状態に応じた制御はなされていない。このため、還元剤の供給量の不足によりＮＯx 吸収剤の再生が不十分になったり、或いは還元剤の供給過剰のために再生に使用されなかった還元剤が大気中に放出されるような問題が生じる。
【０００４】この問題は、ＮＯx 吸収剤再生操作時に、ＮＯx 吸収剤を通過した排気の空燃比が理論空燃比近傍になるように還元剤供給量を制御することにより解決することができる。すなわち、ＮＯx 吸収剤への還元剤供給量が不足する場合には、ＮＯx 吸収剤に流入する排気中の酸素を全部消費することができないため、ＮＯx吸収剤を通過した排気の空燃比はリーンとなる。また、ＮＯx 吸収剤への還元剤供給量が過大な場合には、供給された還元剤の一部が再生操作に消費されず下流側に流出するため、ＮＯx 吸収剤を通過した排気の空燃比はリッチとなる。これに対して、ＮＯx 吸収剤に供給される還元剤の量が適切であれば排気中の酸素は還元剤により完全に消費され、更に、供給された還元剤は排気中の酸素消費と、放出されたＮＯx の還元浄化とに完全に消費されるためＮＯx 吸収剤を通過した排気の空燃比は理論空燃比近傍になるからである。
【０００５】このため、例えばＮＯx 吸収剤出口側に排気中の酸素濃度を検出する酸素濃度センサを設け、この酸素濃度センサの出力に基づいて、ＮＯx 吸収剤を通過した排気の酸素濃度が理論空燃比相当値近傍の値になるように、還元剤供給装置からの還元剤供給量を制御することにより、還元剤の供給量を適切に制御することが可能となる。
【０００６】
【発明が解決しようとする課題】ところが、上記のようにＮＯx 吸収剤出口側に酸素濃度センサを設けて還元剤供給量を制御するようにすると問題が生じる場合がある。以下、この問題について図６を参照して説明する。図６は、上述のようにＮＯx 吸収剤出口に酸素濃度センサを設けて、この酸素濃度センサの出力に基づいて還元剤供給量を制御するようにした場合の構成を示す図である。図６において、１はリーン空燃比運転を行う内燃機関、３は機関１の排気通路を示す。排気通路３は下流側で２つの排気通路３ａ、３ｂに分岐しており、分岐通路３ａ、３ｂの分岐点には排気切換弁２が設けられ、この排気切換弁２の切換により排気通路３ａまたは３ｂの一方に機関排気の大部分を導くことができるようになっている。
【０００７】また、分岐通路３ａ、３ｂのそれぞれには、流入する酸素濃度がリーンのときに排気中のＮＯx を吸収し、流入する排気の酸素濃度が低下すると吸収したＮＯx を放出するＮＯx 吸収剤５ａ、５ｂが設けられ

ている。図６において、１２ａ、１２ｂで示したのは、再生操作時にＮＯχ吸収剤５ａ、５ｂに還元剤を供給する還元剤供給ノズル、７ａ、７ｂで示したのは分岐通路３ａ、３ｂのＮＯχ吸収剤５ａ、５ｂ出口側に設けられた酸素濃度センサである。さらに、分岐通路３ａ、３ｂは酸素濃度センサ７ａ、７ｂ下流側で再び合流しており、分岐通路３ａ、３ｂ合流部には、前述の排気切換弁２と同様な下流側排気切換弁２２が設けられている。

【０００８】図６に示した構成では、一方のＮＯχ吸収剤（例えばＮＯχ吸収剤５ａ）の再生を行う場合には排気切換弁２と２２とを図に実線で示した位置に切り換えて機関１の排気の大部分をＮＯχ吸収剤５ｂ側に流し、ＮＯχ吸収剤５ｂで排気中のＮＯχの吸収を行い、ＮＯχ吸収剤５ａに流入する排気の流量を大幅に低減する。また、このとき還元剤供給ノズル１２ａからＮＯχ吸収剤５ａに還元剤を供給しＮＯχ吸収剤５ａの再生を行う。また、もう一方のＮＯχ吸収剤（ＮＯχ吸収剤５ｂのＮＯχ吸収量が増大し、ＮＯχ吸収能力が飽和に近づいたときには、排気切換弁２、２２を図６の点線の位置に切り換えて、再生が完了したＮＯχ吸収剤（ＮＯχ吸収剤５ａ）で排気中のＮＯχを吸収する。また、このとき還元剤供給ノズル１２ｂから還元剤をＮＯχ吸収剤５ｂに供給してＮＯχ吸収剤５ｂの再生を行う。すなわち、図６の構成ではＮＯχ吸収剤５ａ、５ｂは交互に再生を行い、一方の再生中は他方のＮＯχ吸収剤で排気中のＮＯχ吸収を行う。

【０００９】ところが、図６のような構成においてＮＯχ吸収剤５ａ、５ｂに供給する還元剤の量を適正にするために、還元剤供給ノズル１２ａ、１２ｂからの還元剤供給量をＮＯχ吸収剤５ａ、５ｂ出口側の酸素濃度センサ７ａ、７ｂ出力に基づいてフィードバック制御すると、全般的に還元剤供給量が過大になり、大気に放出される未使用の還元剤の量が増大するという問題が生じる場合がある。

【００１０】本願出願人らの検討の結果、この問題はＮＯχ吸収剤再生時に、再生を行う側のＮＯχ吸収剤出口に設けた酸素濃度センサで検出した酸素濃度が、ＮＯχ吸収剤を通過した排気の酸素濃度より高い酸素濃度を指示するために生じることが判明している。このように、再生側の酸素濃度センサがＮＯχ吸収剤を通過してくる排気の酸素濃度より高い酸素濃度を指示するのは以下の理由によると考えられる。

【００１１】すなわち、ＮＯχ吸収剤再生時には排気中の酸素成分を消費するための還元剤量を低減するために、再生を行う側のＮＯχ吸収剤に流入する排気の流量は排気切換弁２、２２により大幅に低減される。このため、再生中のＮＯχ吸収剤側の分岐通路では大幅に排気流速が低下する。また、還元剤供給によりこの分岐通路中の排気酸素濃度は極めて低くなる。このように、両方の分岐通路３ａ、３ｂ中の排気の酸素濃度に差が生じる結果、合流部の排気切換弁２２部分では、酸素濃度が高い側（ＮＯχを吸収中のＮＯχ吸収剤側）の排気に含まれる酸素が酸素濃度が低い側（再生中のＮＯχ吸収剤側）に向けて拡散により移動するようになる。一方、再生中のＮＯχ吸収剤側では、前述のように排気流速は大幅に低下している。このため、排気切換弁２２を通過して侵入した酸素は再生中のＮＯχ吸収剤側の分岐通路内を拡散して逆流し、ついには酸素濃度センサ位置まで到達するようになり、酸素濃度センサ７の指示が実際にＮＯχ吸収剤を通過した排気の酸素濃度より高くなる現象が生じるのである。

【００１２】図７は、図６において再生中のＮＯχ吸収剤（ＮＯχ吸収剤５ａ）側の分岐通路３ａ各位置に実際に酸素濃度センサを挿入して各部分の酸素濃度を計測した結果を示している。図７において、区間Ｉは排気切換弁２からＮＯχ吸収剤５ａ入口までの区間の酸素濃度を、区間IIはＮＯχ吸収剤５ａ入口から出口までのＮＯχ吸収剤内部の区間の酸素濃度を、また、区間III はＮＯχ吸収剤５ａ出口から下流側排気切換弁２２までの区間の酸素濃度をそれぞれ示している（図６参照）。図７に示すように、区間Ｉでは供給された還元剤はまだ排気中の酸素と反応していないため排気中の酸素濃度は高く、区間IIではＮＯχ吸収剤の触媒作用により還元剤と排気中の酸素が反応し、酸素が消費されるため酸素濃度は略ゼロ付近に低下している。ところが、区間IIの端部（ＮＯχ吸収剤５ａの下流側端面付近）では、酸素濃度は再度上昇に転じ、区間III では、下流側排気切換弁２２に近づくにつれて酸素濃度が高くなっている。すなわち、排気切換弁２２を通して侵入してくる酸素分子の拡散により、ＮＯχ吸収剤下流側では排気切換弁２２に近づくにつれて排気中の酸素濃度が高くなる傾向が生じていることが判る。図７に点線で示したのは、分岐通路３ａ、３ｂの合流部に下流側排気切換弁２２を設けずに上流側排気切換弁２のみを用いて排気の切換を行った場合の結果を示す。この場合には、下流側排気切換弁２２がないために侵入する酸素の量は更に増大し、ＮＯχ吸収剤下流側での酸素濃度は更に高くなっている。また、図示していないが、分岐通路３ａ、３ｂを合流させずに個別に大気に開放した場合にも、大気側からの酸素の拡散により同様の減少が生じることが判明している。

【００１３】本来、ＮＯχ吸収剤に供給する還元剤の量は図７の区間II中央付近の酸素濃度に基づいて制御する必要がある。しかし、図６のような構成では、還元剤供給量は上記区間III 部分の、区間IIより高い酸素濃度に基づいて制御されることになるため、還元剤の供給量が過大になる前述の問題が生じるのである。この問題は、ＮＯχ吸収剤中に酸素濃度センサを挿入して、図７、区間IIにおける酸素濃度を正確に検出するようにすれば解決可能である。しかし、ＮＯχ吸収剤は機関運転中極めて高温になるため、酸素濃度センサをＮＯχ吸収剤中に

挿入するとセンサの耐久性の問題が生じる。また、ＮＯX 吸収剤中にセンサを挿入することはＮＯX 吸収剤自体の機械的強度低下などの問題を生じるため好ましくない。

【００１４】本発明は、上記問題に鑑み、ＮＯX 吸収剤内にセンサを挿入することなく、ＮＯX 吸収剤下流側に配置した酸素濃度センサにより、ＮＯX 吸収剤を通過した排気の酸素濃度を正確に検出可能とする手段を提供することを目的としている。

【００１５】

【課題を解決するための手段】本発明によれば、リーン空燃比運転を行う内燃機関の排気浄化装置であって、前記内燃機関の排気通路に互いに並列に接続された２つの分岐通路と、該分岐通路のそれぞれに配置された、流入する排気の空燃比がリーンのときに排気中のＮＯX を吸収し、排気酸素濃度が低下したときに吸収したＮＯX を放出するＮＯX吸収剤と、前記ＮＯX 吸収剤に流入する排気流量をそれぞれ個別に低減することが可能な排気切換弁と、前記ＮＯX 吸収剤のそれぞれに個別に還元剤を供給することが可能な還元剤供給装置と、前記それぞれのＮＯX 吸収剤の下流側分岐通路中の排気の酸素濃度を検出する酸素濃度センサとを備え、前記ＮＯX 吸収剤の一方に排気中のＮＯX を吸収させた後、前記排気切換弁により該一方のＮＯX 吸収剤に流入する排気流量を低減し、前記酸素濃度センサの出力に基づいて前記還元剤供給装置から該一方のＮＯX 吸収剤に還元剤を供給して、該一方のＮＯX 吸収剤から吸収したＮＯX を放出させるとともに放出されたＮＯX を還元浄化する操作を、交互に前記ＮＯX 吸収剤について行う内燃機関の排気浄化装置において、前記分岐通路下流側から前記酸素濃度センサに逆流してくる酸素を消費する酸素消費手段を設けたことを特徴とする内燃機関の排気浄化装置が提供される。

【００１６】

【作用】ＮＯX 吸収剤再生時に、拡散により下流側から酸素濃度センサに向けて逆流してくる酸素は、酸素消費手段により消費される。このため、下流側から逆流してくる酸素が酸素濃度センサに到達することが阻止され、ＮＯX 吸収剤再生時の酸素濃度センサ近傍の排気の酸素濃度は、ＮＯX 吸収剤を通過した排気の酸素濃度（図７、区間II中央部分）と略等しくなり、酸素濃度センサ出力はＮＯX 吸収剤を通過した排気の酸素濃度を正確に表すようになる。

【００１７】

【実施例】以下添付図面を用いて本発明の実施例について説明する。図１は本発明の排気浄化装置の一実施例の構成を示す。図１において、図６と同じ参照符号は図６と同一の要素を示している。図１において、１はディーゼルエンジンや希薄燃焼を行うガソリンエンジン等のリーン空燃比の燃焼を行うことのできる内燃機関、３は内燃機関１の排気通路を示す。排気通路３には２つの分岐通路３ａ、３ｂが設けられており、通路３ａ、３ｂには後述のように、流入する排気空燃比がリーンのときに排気中のＮＯXを吸収し、排気中の酸素濃度が低下したときに吸収したＮＯX を放出するＮＯX吸収剤、それぞれ５ａ、５ｂが接続されている。

【００１８】また、排気通路３の通路３ａ、３ｂの分岐部には排気切換弁２が設けられ、排気通路３ａ、３ｂの任意の一方を所定の開度に閉鎖して排気通路３ａ、３ｂに排気を分配するようになっている。例えば排気切換弁２が図１に実線で示した位置に切り換えられると、排気の大部分は分岐通路３ｂ側に流入し、分岐通路３ａ側に流入する排気流量が低減される。また、排気切換弁２が図１に点線で示した位置に切り換えられると、排気の大部分は分岐通路３ａ側に流入し、分岐通路３ｂ側に流入する排気流量が低減される。図に２ａで示すのは、後述するエンジン制御回路（ＥＣＵ）２０からの制御信号により切換弁２を駆動して所定の切り換え位置をとらせるための、負圧アクチュエータ等の適宜な形式のアクチュエータである。

【００１９】また、分岐通路３ａ、３ｂはＮＯX 吸収剤５ａ、５ｂ下流側で再び合流しており、この合流部には排気切換弁２と同様な排気切換弁２２と、アクチュエータ２２ａとが設けられている。排気切換弁２２は、排気切換弁２と連動して作動し、再生中のＮＯX 吸収剤の側の分岐通路にもう一方の分岐通路からの排気が逆流することを防止している。

【００２０】更に、分岐通路３ａ、３ｂのＮＯX 吸収剤５ａ、５ｂ上流側には後述する還元剤供給装置１１からＮＯX 吸収剤５ａ、５ｂに還元剤を供給する還元剤供給ノズル、それぞれ１２ａ、１２ｂが接続されている。また、図１に７ａ、７ｂで示すのは、それぞれ分岐通路３ａ、３ｂのＮＯX 吸収剤５ａ、５ｂ下流側に配置された酸素濃度センサである。酸素濃度センサ７ａ、７ｂはＮＯX 吸収剤５ａ、５ｂを通過した排気中の酸素濃度を検出する。本実施例では、後述のように、ＮＯX 吸収剤５ａ、５ｂの再生中に還元剤供給装置１１から再生中のＮＯX 吸収剤５ａ、５ｂに供給する還元剤供給量を、酸素濃度センサ７ａ、７ｂの出力に応じて制御している。

【００２１】また、本実施例では、それぞれの分岐通路３ａ、３ｂの酸素濃度センサ７ａ、７ｂ下流側には、酸素消費手段としての酸化触媒１０１ａ、１０１ｂが設けられている。図に２０で示すのはエンジン１の制御回路（ＥＣＵ）である。ＥＣＵ２０はＣＰＵ、ＲＡＭ、ＲＯＭ、及び入力ポート、出力ポートを相互に双方向バスで接続した構成の公知のディジタルコンピュータからなり、エンジンの燃料噴射量制御等の基本制御を行っている。また、本実施例ではＥＣＵ２０は、更に、図示しない駆動回路や負圧制御弁等を介してアクチュエータ２ａ、２２ａを駆動して排気切換弁２、２２の切り換え位

置制御を行うほか、酸素濃度センサ７ａ、７ｂの出力に基づいて還元剤供給装置１１からの還元剤供給量の制御を行う。これらの制御のためＥＣＵ２０の入力ポートには、酸素濃度センサ７ａ、７ｂからの酸素濃度信号が入力されている他、エンジン回転数、機関吸入空気量等の信号がそれぞれ図示しないセンサから入力されている。

【００２２】酸化触媒１０１ａ、１０１ｂは、例えばハニカム状の金属担体に白金Ｐｔ、パラジウム等の酸化触媒を担持したものであり、後述するように、排気切換弁２２を通って分岐通路３ａ、３ｂを下流側から逆流してくる酸素を、酸化触媒を通過する排気中の還元剤と反応させることにより、下流側から逆流してくる酸素を消費する酸素消費手段としての作用を行うものである。

【００２３】還元剤供給装置１１は還元剤容器、加圧ポンプ等から構成される還元剤供給源１３と、還元剤供給源１３から還元剤供給ノズル１２ａ、１２ｂに供給される還元剤の流量を調節する制御弁１４ａ、１４ｂ及び、ノズル１２ａ、１２ｂと制御弁１４ａ、１４ｂとの間に配置された排気逆流防止用の逆止弁１５ａ、１５ｂとを備えている。制御弁１４ａ、１４ｂは、後述するＮＯx吸収剤５ａ、５ｂの再生操作時、ＥＣＵ２０の制御信号に応じて所定の開度をとり、開度に応じた量の還元剤をＮＯx吸収剤５ａ、５ｂに供給するものである。

【００２４】ＮＯx吸収剤５ａ、５ｂのＮＯx放出、還元操作（再生操作）に使用する還元剤としては、排気中で一酸化炭素などの還元成分や炭化水素成分を発生するものであれば良く、水素、一酸化炭素等の気体や、プロパン、プロピレン、ブタン等の液状又は気体状の炭化水素、または、ガソリン、軽油、灯油等の液体燃料等が使用できる。

【００２５】ＮＯx吸収剤５ａ、５ｂは例えばアルミナ等の担体を使用し、この担体上に例えばカリウムＫ，ナトリウムNa，リチウムLi，セシウムCsのようなアルカリ金属、バリウムBa，カルシウムCaのようなアルカリ土類、ランタンLa，イットリウムＹのような希土類から選ばれた少なくとも一つと、白金Ｐｔのような貴金属とが担持されている。このＮＯx吸収剤５ａ、５ｂは流入する排気の空燃比がリーンの場合にはＮＯxを吸収し、酸素濃度が低下するとＮＯxを放出するＮＯxの吸放出作用を行う。

【００２６】なお、上述の排気空燃比とは、ここではＮＯx吸収剤５ａ、５ｂの上流側の排気通路やエンジン燃焼室、吸気通路等にそれぞれ供給された空気量の合計と、燃料と還元剤の合計との比を意味するものとする。従って、ＮＯx吸収剤５ａ、５ｂの上流側排気通路に燃料、還元剤または空気が供給されない場合には排気空燃比はエンジンの運転空燃比（エンジン燃焼室内の燃焼における空燃比）と等しくなる。

【００２７】本実施例では、リーン空燃比の燃焼を行う機関が使用されているため、通常運転時の排気空燃比はリーンであり、ＮＯx吸収剤５ａ、５ｂは排気中のＮＯxの吸収を行う。また、還元剤供給装置１１から排気中に還元剤が導入されて酸素濃度が低下すると、ＮＯx吸収剤５ａ、５ｂは吸収した還元剤の放出を行う。この吸放出作用の詳細なメカニズムについては明らかでない部分もある。しかし、この吸放出作用は図５に示すようなメカニズムで行われているものと考えられる。次にこのメカニズムについて担体上に白金ＰｔおよびバリウムＢａを担持させた場合を例にとって説明するが他の貴金属、アルカリ金属、アルカリ土類、希土類を用いても同様なメカニズムとなる。

【００２８】すなわち、流入排気がかなりリーンになると流入排気中の酸素濃度が大巾に増大し、図５(A)に示されるようにこれら酸素O_2がO_2^-またはO^{2-}の形で白金Ｐｔの表面に付着する。一方、流入排気中のＮＯは白金Ｐｔの表面上でこのO_2^-またはO^{2-}と反応し、NO_2となる（$2NO+O_2 \rightarrow 2NO_2$）。次いで生成された$NO_2$の一部は白金Ｐｔ上で酸化されつつ吸収剤内に吸収されて酸化バリウムＢａＯと結合しながら、図５(A)に示されるように硝酸イオンNO_3^-の形で吸収剤内に拡散する。このようにしてＮＯxがＮＯx吸収剤５ａ、５ｂ内に吸収される。

【００２９】従って、流入排気中の酸素濃度が高い限り白金Ｐｔの表面でNO_2が生成され、吸収剤のＮＯx吸収能力が飽和しない限りNO_2が吸収剤内に吸収されて硝酸イオンNO_3^-が生成される。これに対して流入排気中の酸素濃度が低下してNO_2の生成量が減少すると反応が逆方向（$NO_3^- \rightarrow NO_2$）に進み、こうして吸収剤内の硝酸イオンNO_3^-がNO_2の形で吸収剤から放出される。すなわち、流入排気中の酸素濃度が低下するとＮＯx吸収剤５ａ、５ｂからＮＯxが放出されることになる。

【００３０】一方、流入排気中にＨＣ、ＣＯ等の還元成分が存在すると、これらの成分は白金Ｐｔ上の酸素O_2^-またはO^{2-}と反応して酸化され、排気中の酸素を消費して排気中の酸素濃度を低下させる。また、排気中の酸素濃度低下によりＮＯx吸収剤５ａ、５ｂから放出されたNO_2は図５(B)に示すようにＨＣ，ＣＯと反応して還元される。このようにして白金Ｐｔの表面上にNO_2が存在しなくなると吸収剤から次から次へとNO_2が放出される。

【００３１】すなわち、流入排気中のＨＣ，ＣＯは、まず白金Ｐｔ上のO_2^-またはO^{2-}とただちに反応して酸化され、次いで白金Ｐｔ上のO_2^-またはO^{2-}が消費されてもまだＨＣ，ＣＯが残っていればこのＨＣ，ＣＯによって吸収剤から放出されたＮＯx、および排気とともに流入するＮＯxが還元される。本実施例では、排気切換弁２、２２の操作により交互にＮＯx吸収剤５ａと５ｂのＮＯx吸収と放出とを行う。すなわち、本実施例では、排気切換弁２、２２の操作により一方のＮＯx吸収

剤（例えば５ａ）に大部分の排気を流してＮＯ$_X$を吸収させる。また、予め設定した所定の時間ＮＯ$_X$吸収を行ってＮＯ$_X$吸収剤５ａのＮＯ$_X$吸収量が増大してくると、排気切換弁２、２２を切り換えて他方のＮＯ$_X$吸収剤５ｂに排気を流し、ＮＯ$_X$吸収剤５ａに流入する排気流量を低減するとともに、還元剤供給ノズル１２ａからＮＯ$_X$吸収剤５ａに還元剤を供給してＮＯ$_X$吸収剤５ａの再生を行う。また、切換え後所定時間が経過してＮＯ$_X$吸収剤５ｂのＮＯ$_X$吸収量が増大してくると、再度排気切換弁２、２２の切換えを行い、ＮＯ$_X$吸収剤５ａ側に排気を流してＮＯ$_X$吸収剤５ａによるＮＯ$_X$吸収を再開するとともにＮＯ$_X$吸収剤５ｂの再生を行う。

【００３２】本実施例では、ＮＯ$_X$吸収剤５ａ、５ｂの再生に使用する還元剤の量を低減するために、排気切換弁２、２２の位置を切り換えて再生を行うＮＯ$_X$吸収剤に流入する排気の流量を低減し、排気中の酸素を消費するために必要な還元剤の量を低減するとともに、再生中のＮＯ$_X$吸収剤の出口側に設けた酸素濃度センサの出力に基づいて還元剤供給装置１１からの還元剤供給量を制御して、ＮＯ$_X$吸収剤に適切な量の還元剤を供給するようにしている。

【００３３】図２は、本実施例のＮＯ$_X$吸収剤５ａ、５ｂの再生操作制御を示すフローチャートである。本ルーチンはエンジン制御回路（ＥＣＵ）２０により、所定時間毎に実行される。図２においてルーチンがスタートすると、ステップ２０１では、現在ＮＯ$_X$吸収を実行中のＮＯ$_X$吸収剤の再生操作実行条件が成立しているか否かが判定される。ここで、ＮＯ$_X$吸収剤の再生操作実行条件は、①ＮＯ$_X$吸収時間（前回ＮＯ$_X$吸収剤の切換を行ってからの経過時間）が所定時間を越えていること、②エンジン排気温度が所定値以上であること、であり、上記①と②のいずれかが成立していないときには、ルーチンはステップ２２１に進み、後述する計時カウンタＴと排気切換弁の切換フラグＦの値をゼロにセットした後ルーチンを終了する。上記①でＮＯ$_X$吸収剤のＮＯ$_X$吸収時間を判定しているのは、ＮＯ$_X$吸収剤のＮＯ$_X$吸収量がある程度増加したときにのみＮＯ$_X$吸収剤の再生を行い、頻繁な再生操作の実行を避けるためであり、上記②で排気温度を判定しているのは、排気温度が低いとＮＯ$_X$吸収剤自体の温度も低くなっているため、還元剤を供給した場合のＮＯ$_X$吸収剤からのＮＯ$_X$の放出速度が低下し、効率的な再生操作を行うことができないためである。

【００３４】従って、本実施例では、ステップ２０１で上記①と②の条件の両方が成立した場合にのみ、ステップ２０３からステップ２１９の再生操作が実行される。すなわち、ステップ２０１でＮＯ$_X$吸収剤の再生条件が成立した場合には、ステップ２０３で排気切換弁の切換フラグＦの値が１にセットされているか否かを判定し、Ｆ≠１の場合にはステップ２０５で排気切換弁２、２２の切換を行い、再生条件が成立したＮＯ$_X$吸収剤側の分岐通路に流入する排気の流量を所定量まで低減し、次いでステップ２０７でフラグＦの値を１にセットした後ステップ２０９に進む。また、ステップ２０３でＦ＝１の場合は排気切換弁の切換を行わずに、直接ステップ２１１に進む。上記切換フラグＦは、ＮＯ$_X$吸収剤の再生条件成立後に排気切換弁２、２２の切換を１回だけ行うようにするために用いられるフラグである。

【００３５】ステップ２０９は再生操作の終了条件が成立しているか否かの判定を示す。すなわち、ステップ２０９では計時カウンタＴの値が所定値Ｔ$_0$以上か否かが判定され、Ｔ≧Ｔ$_0$であれば、還元剤供給装置１１の制御弁１４ａ（または１４ｂ）の設定値Ｒをゼロにセットしてステップ２１９に進み、還元剤供給装置１１の制御弁１４ａ（または１４ｂ）の開度を制御する（この場合、Ｒ＝ゼロであるので、制御弁１４ａ、１４ｂはともに全閉とされる。）。ここで、所定値Ｔ$_0$はＮＯ$_X$吸収剤の再生に必要な時間であり、ＮＯ$_X$吸収剤のタイプ、サイズなどにより予め実験等により設定される。すなわち、ステップ２１１では、再生操作開始後の経過時間Ｔが所定の再生実行時間以上になっているかを判断し、再生操作が所定時間実行されている場合には、ステップ２１０で還元剤供給装置の制御弁１４ａ（または１４ｂ）を全閉にしてＮＯ$_X$吸収剤への還元剤供給を停止する。

【００３６】ステップ２０９で所定の再生操作実行時間が経過していない場合には、ルーチンはステップ２１１に進み、再生操作を実行する側のＮＯ$_X$吸収剤下流に配置された酸素濃度センサ（７ａまたは７ｂ）から排気中の酸素濃度Ｃの読み込みが行われ、ステップ２１２では、この酸素濃度Ｃが理論空燃比相当の酸素濃度Ｃ$_{ST}$以上か（すなわち排気空燃比がリーンか）否かが判定される。

【００３７】ステップ２１２で酸素濃度センサ（７ａまたは７ｂ）で検出された排気空燃比がリーン（Ｃ≧Ｃ$_{ST}$）である場合には、ステップ２１３が実行され、還元剤供給装置の制御弁（１４ａまたは１４ｂ）の開度が一定量αだけ増大され、還元剤供給量が増大される。また、ステップ２１２で排気空燃比がリッチの場合にはステップ２１５が実行され、制御弁開度は一定量βだけ低減され、還元剤供給量が低減される。ここで、α、βは、予め設定した一定値である。αとβの値は同一としてもよいが、αとβとの値に差を設けることにより、ＮＯ$_X$吸収剤を通過する排気の空燃比を理論空燃比よりリッチ側またはリーン側に維持することができる。例えばα＞βとすることにより、排気空燃比は理論空燃比よりややリッチ側に維持される。

【００３８】また、上記操作実行後ステップ２１７では、計時カウンタＴの値がプラス１カウントアップされ、ステップ２１９では、ステップ２１３または２１５で設定された制御弁開度Ｒが図示しない駆動回路に出力

される。上記ルーチンの実行により、ＮＯx 吸収剤再生時にはそのＮＯx 吸収剤下流側の酸素濃度センサ出力に基づいて下流側排気空燃比が理論空燃比になるように還元剤供給量がフィードバック制御される。このため、酸素濃度センサ７ａ、７ｂの出力は、ＮＯx 吸収剤５ａ、５ｂを通過する排気中の酸素濃度を正確に検出する必要がある。

【００３９】前述のように、本実施例では酸素濃度センサ７ａ、７ｂ下流側の分岐通路３ａ、３ｂには酸素消費手段としての酸化触媒１０１ａ、１０１ｂが設けられている。このため、ＮＯx 吸収剤の再生中に下流側排気切換弁２２を通過してＮＯx 吸収中の側の分岐通路から酸素が拡散してくる酸素は、酸化触媒１０１ａ、１０１ｂで、還元剤供給装置から供給され、排気とともにＮＯx 吸収剤を通過する還元剤と反応して消費され、酸素濃度センサ７ａ、７ｂには到達しない。従って、再生操作実行中の酸素濃度センサ７ａ、７ｂの出力はＮＯx 吸収剤を通過した排気の空燃比を正確に反映することになり、酸素濃度センサ７ａ、７ｂの出力に基づいて還元剤供給量を制御することにより、適切な量の還元剤をＮＯx 吸収剤に供給することが可能となっている。

【００４０】次に、本発明の別の実施例の構成を図３に示す。図１の実施例では、酸素濃度センサ７ａ、７ｂと排気切換弁２２との間の分岐通路３ａ、３ｂにそれぞれ酸化触媒を設けていたが、図３(A) に示すように本実施例では、各分岐通路３ａ、３ｂに独立した酸化触媒を設ける代わりに、排気切換弁に酸化触媒を一体化して組み込んだ排気切換弁１０２を用いている点が相違している。

【００４１】すなわち、本実施例の排気切換弁１０２は、図３(B) に示すように、円板状の弁体１０２ａの中央に酸化触媒を担持したハニカム状の金属担体１０２ｂを嵌装した構成とされ、ＮＯx 吸収剤を通過した排気は、この触媒担体を通過して合流部に流れるようになっている。再生中のＮＯx 吸収剤側の分岐通路への酸素の侵入は濃度差による拡散によって生じるのみであり、その量は比較的少ない。従って、酸化触媒は比較的小さな容量であっても充分に酸素濃度センサ７ａ、７ｂへの酸素の到達を防止することができる。このため、図３の実施例では、小容量の酸化触媒を一体に排気切換弁に組み込むことにより、切換弁の動作を阻害することなく酸素濃度センサ７ａ、７ｂへの酸素の到達を防止している。本実施例によれば、簡易な構成で図１の実施例と同じ効果を達成することが可能となる利点がある。

【００４２】図４は、本発明の更に別の実施例の構成を示す図である。図１の実施例では、酸素濃度センサをそれぞれの分岐通路に設けていたが、本実施例では、単一の酸素濃度センサ１０７を用いて両方のＮＯx 吸収剤５ａ、５ｂの再生時の還元剤供給量制御を行う点が相違している。図４において、ＮＯx 吸収剤５ａ、５ｂの入口部分には、ポート１０３ａ、１０３ｂが設けられ、配管１０４ａ、１０４ｂを介して排気切換弁２と連動する切換弁１０５の入口ポートに接続されている。また、切換弁１０５の出口ポートは小容量のＮＯx 吸収剤１０６、同じく小容量の酸化触媒１０８、排気ポンプ１０９を介して、分岐通路３ａ、３ｂの合流部に設けられた排気ポート１１０に接続されている。

【００４３】また、本実施例では、単一の酸素濃度センサ１０７がＮＯx 吸収剤１０６と酸化触媒１０８とを接続する配管に設けられている。本実施例では下流側の排気切換弁２２は設けられておらず、ＮＯx 吸収剤再生のための排気の切り換えは上流側排気切換弁２のみによって行われる。本実施例では、切換弁１０５は上流側排気切換弁２と連動し、再生操作実行中のＮＯx 吸収剤側のポート（１０３ａまたは１０３ｂ）をＮＯx 吸収剤１０６に接続する。これにより、再生中のＮＯx 吸収剤に流入する排気と還元剤との混合物の一部が排気ポンプ１０９により吸引され、ＮＯx 吸収剤１０６を通過する。

【００４４】このため、ＮＯx 吸収剤１０６には、再生中のＮＯx 吸収剤に供給されるのと同じ還元剤濃度の排気が供給されるので、ＮＯx 吸収剤１０６出口での酸素濃度は、再生中のＮＯx 吸収剤の出口における排気酸素濃度と略同じになる。また、排気ポート１１０から拡散してくる酸素は酸化触媒１０８により消費されるため、酸素濃度センサ１０７には到達せず、酸素濃度センサ１０７近傍の排気酸素濃度は再生中のＮＯx 吸収剤を通過した排気の酸素濃度と略同じになる。

【００４５】従って、酸素濃度センサ１０７の出力に基づいて、図２と同様の制御を行うことによりＮＯx 吸収剤再生時の還元剤供給量が適切に制御される。本実施例によれば、使用する酸素濃度センサの数を低減し、簡易な制御を行うことができる利点がある。なお、前述の各実施例では、下流側から拡散してくる酸素が酸素濃度センサに到達することを阻止する酸素消費手段として酸化触媒を用いているが、本発明の酸素消費手段は酸化触媒に限定されるものではなく、酸素と還元剤とを反応させることができるものであれば酸素消費手段として使用することができる。たとえば、酸素消費手段として、酸化触媒の代わりに小容量のＮＯx 吸収剤を用いても同様の効果を得ることができる。

【００４６】

【発明の効果】本発明によれば、ＮＯx 吸収剤出口の排気酸素濃度を検出する酸素濃度センサに、下流側から拡散してくる酸素が到達することを阻止する酸素消費手段を設けたことにより、排気通路に並列に接続した２つのＮＯx 吸収剤を交互に再生する際に再生中のＮＯx 吸収剤下流側の酸素濃度センサ出力に基づいてＮＯx 吸収剤への還元剤供給量を正確に制御することが可能となり、ＮＯx 吸収剤への還元剤供給量不足による不十分な再生や、還元剤供給過剰による大気への未使用還元剤の放出

を防止することができる効果が得られる。

【図面の簡単な説明】

【図１】本発明の一実施例の構成を説明する図である。

【図２】図１の実施例におけるＮＯx 吸収剤再生制御の例を示すフローチャートである。

【図３】本発明の、図１とは別の実施例の構成を説明する図である。

【図４】本発明の更に別の実施例の構成を説明する図である。

【図５】ＮＯx 吸収剤のＮＯx 吸放出作用を説明する図である。

【図６】従来技術の問題点を説明する図である。

【図７】従来技術の問題点を説明する図である。

【符号の説明】

１…内燃機関

２，２２…排気切換弁

３…排気通路

３ａ，３ｂ…分岐通路

５ａ，５ｂ…ＮＯx 吸収剤

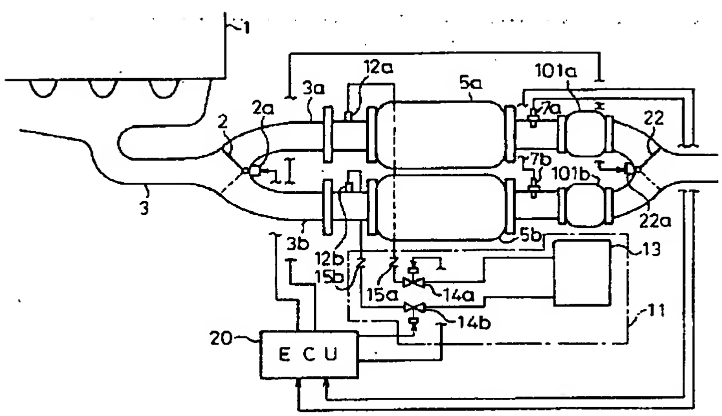
７ａ，７ｂ…酸素濃度センサ

１１…還元剤供給装置

２０…エンジン制御回路

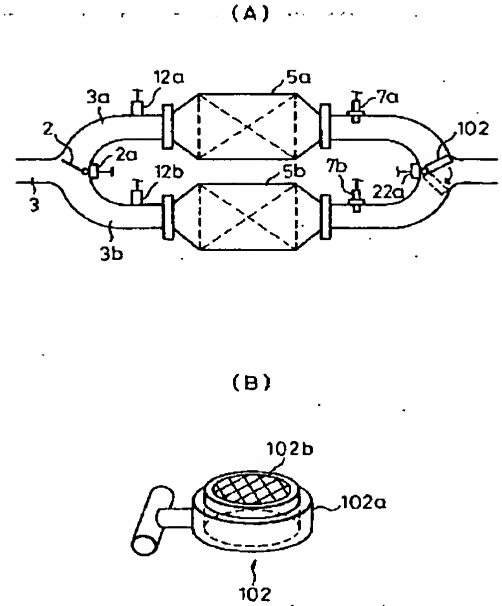
１０１ａ，１０１ｂ…酸化触媒（酸素消費手段）

【図１】

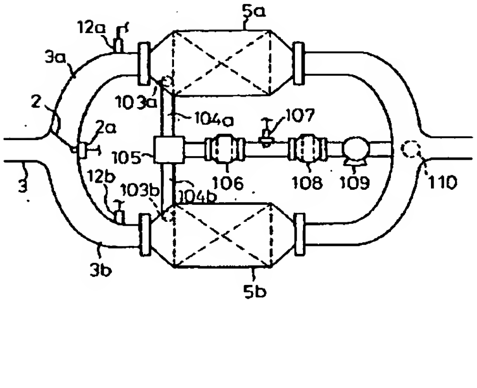


1…内燃機関　　12a，12b…還元剤供給ノズル
2，22…排気切換弁　　20…エンジン制御回路
3a，3b…分岐通路　　101a，101b…酸化触媒
5a，5b…ＮＯx吸収剤　　（酸素消費手段）

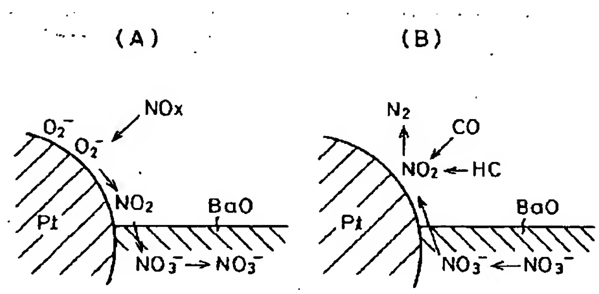
【図３】



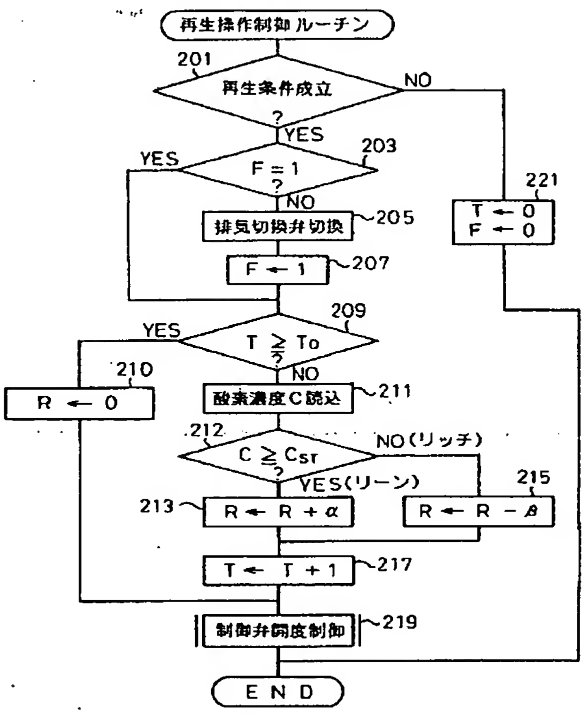
【図４】



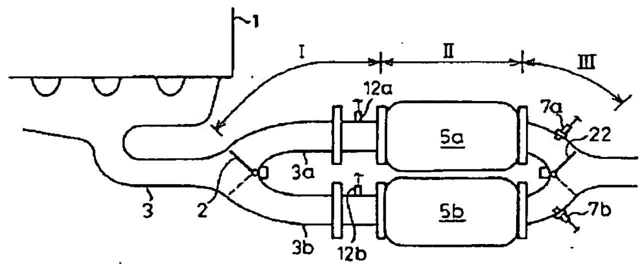
【図５】



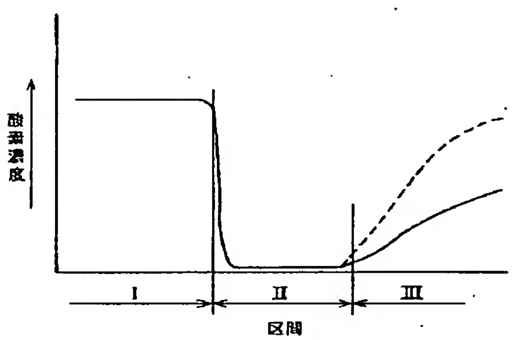
【図２】



【図６】



【図７】



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